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ANNALES
DE L'
INSTITUT PHYTOPATHOLOGIQUE BENAKI

NOUVELLE SÉRIE

KIPHISSIA-ATHÈNES
GRÈCE

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ANNALES

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VOLUME 1 — 1957 — N° 2

RAPPORT SOMMAIRE SUR LES PRINCIPALES MALADIES DES PLANTES CULTIVÉES, OBSERVÉES EN GRÈCE AU COURS DE L'ANNÉE 1956

par

S. D. DÉMÉTRIADÈS, D. G. ZACHOS, A. J. PAPAÏOANNOU et P. TH. CONSTANTINOU

Les principales maladies qui ont été déterminées à l'Institut Phytopathologique Benaki au cours de l'année 1956, sont les suivantes:

SUR VINGE

1. L'*Uncinula necator* (Schw.) Burr. provoqua quelques dégâts sur les grappes à Varnava en Attique.

2. Le mal de l'Esca fut déterminé aux vignobles des villages N. Épivatae, Peraia, Agia Trias, Épanomi et autres localités dans la région de Thessaloniki. Les vignes attaquées, de la variété Razaki, étaient greffées sur 41 B Aramon × Rupestris Ganzin. La maladie a aussi été observée à Platystomon dans l'île de Leucas sur la variété Vartzami.

3. Le pourridié dû à l'*Armillaria mellea* (Vahl.) Quelet a été observé dans la région de Nestorion à Kastoria.

4. Le *Macrophoma flaccida* (Viala et Ravaz) Cavara a fait quelques dégâts sur la variété Razaki et secondairement sur celle de Soultanina à Kalloni de la région d'Hiraclion (île de Crète).

5. Des tumeurs provoquées par le *Bacterium tumefaciens* Smith et Towns. ont été observées à Grevena dans la région de Kozani (Macédoine occidentale).

6. La dégénérescence infectieuse fut déterminée dans la région de Pyrgi dans l'île de Chio, à Platystomon de l'île de Leucas et à Zitsa en Épire.

7. Des dégâts causés par les herbicides phytohormoniques furent constatés dans la région de Kozani.

SUR OLIVIER

1. Le *Cycloconium oleaginum* Cast. dans la région de Pikermi et Sycaminon en Attique et à Kontostavlos dans la région de Corinthe.

2. Des dégâts sérieux dus au froid furent constatés dans la région de Volo.

3. Des dégâts importants provoqués par les poussières provenant des Usines à Ciment avoisinantes furent de nouveau observés dans la région d'Éleusis.

SUR AGRUMES

BIGGARADIER

Le *Rhizoctonia solani* Kühn causa des dégâts sur les plantules de semis à Vello dans la région de Corinthe.

CITRONNIER

1. Le *Septoria depressa* McAlp. causa des sérieux dégâts sur les citrons dans toute la région de la côte nord du Péloponnèse et à l'île de Poros.

2. Carence de zinc dans l'île de Poros.

3. Carence ferrique à Xylocastro, de la région de Corinthe.

4. Carence de magnésium à Vello de la même région.

MANDARINIER

1. L'«oleocellosis» sur fruits à Bathy de l'île de Kalymnos.

2. Des taches sur les fruits, à un pourcentage atteignant 70%, causées probablement par les pulvérisations de Dieldrin 50% à une concentration de 1,75 par litre. Les pulvérisations avaient été effectuées dans la première dizaine des mois de septembre et d'octobre. Pendant cette période la température atteignit 25 à 27° C. Dans l'île de Kos, (Dodecannèse).

ORANGER

1. Le *Colletotrichum gloeosporioides* Penz. sur branches à Viaradika de l'île de Kythira.

2. Une «carpoptose» de juin à Candie de l'île de Crète.

3. Carence de potassium à Xylocastro (Région de Corinthe).

4. Carence de zinc dans l'île de Poros (Province de Trezène).

SUR ARBRES FRUITIERS

ABRICOTIER

1. Le *Sclerotinia laxa* Aderh. et Ruhl., sur branches à Agios Nikolaos dans l'île d'Eubée et sur jeunes pousses à Leptokarya de la région de Pieria.

2. Un *Oidium sp.* sur fruits à Xylocastro.

3. Carence ferrique à Éleusis en Attique.

4. Des dégâts dus à la sécheresse dans la même région.

AMANDIER

Le *Taphrina deformans* (Berk.) Tul. sur feuilles dans la région d'Athènes.

CERISIER

Le *Bacterium tumefaciens* Smith et Towns. provoquant des tumeurs sur les racines à Filothei près d'Athènes.

NÉFLIER DU JAPON

Le *Fusicladium eriobotryae* (Cav.) Sacc. fut déterminé sur feuilles et fruits dans la région d'Athènes et à Kiphissia ainsi qu'à Mavrovounion de la région de Gythion.

PÊCHER

1. Le *Taphrina deformans* (Berk.) Tul. dans la région d'Athènes et de Kiphissia.

2. Un *Oidium sp.* sur les jeunes pousses et les fruits à Xylocastro dans la région de Corinthe.

3. Le *Coryneum Beijerinckii* Oud. causa des dégâts sur les feuilles et les fruits dans la même région.

PISTACHIER

Un *Phytophthora sp.* au collet à Amaroussion en Attique.

POIRIER

1. Le *Pseudomonas syringae* van Hall fut observé sur les jeunes branches à Xylocastro.

2. Le *Rosellinia necatrix* (Hart.) Berl. dans la même région.

3. Des dégâts provoqués par des vents chauds sur fruits à Vello de la région de Corinthe.

POMMIER

1. Le *Podosphaera leucotricha* (Ell. et Ev.) Salm. sur jeunes pousses à Trikala de la région de Corinthe.

2. Des pourridiés dus à *Rosellinia necatrix* (Hart.) Berl. à Verria et à l'*Armillaria mellea* (Vahl.) Quelet dans la région de Lassithi (île de Crète).

PRUNIER

1. Le *Coryneum Beijerinckii* Oud. sur feuilles dans la région d'Athènes.

2. Une attaque du collet due à un Phycomycete à Komotini de la région de Rodopi.

SUR PLANTES INDUSTRIELLES

COTTON

1. Le *Rhizoctonia solani* Kühn dans l'île de Lemnos.

2. Le *Rhizopus nigricans* Ehrenb. sur les capsules dans la région de Trikala en Thessalie.

3. Le *Xanthomonas malvacearum* (E. F. Smith) Dowson sur des jeunes plantes dans la région d'Arta.

4. Une fonte de semis causée par le *Fusarium sp.*, *Rhizoctonia solani* Kühn et *Pythium sp.* dans la région de Kopaïs en Béotie.

5. Un *Phytophthora sp.* attaquant le collet fut observé à Nissi dans la région de Verria sur des terrains riches en matières organiques et inondés pendant l'hiver.

6. Des dégâts causés par des herbicides phytohormoniques dans la région de Levadia en Béotie.

TABAC

Une attaque du collet causée par un *Phytophthora sp.* à Sidirocastron dans la région de Serrai.

BETTERAVES SUCRIÈRES

Le *Rhizoctonia solani* Kühn à Iasmon de la région de Rodopi.

SUR PLANTES POTAGÈRES

ARTICHAUT

Dans l'île de Rhodes, des brûlures assez graves ont été causées sur les feuilles par l'emploi d'un fongicide contenant du soufre et du cuivre. Les premiers symptômes apparurent 48 heures après le poudrage et au bout de 6 jours les feuilles présentaient des brûlures très nettes.

Étant donné que des dégâts pareils se présentaient pour la première fois sur l'artichaut, on a fait quelques essais dans le but d'étudier d'une part la phytotoxicité du fongicide sur les plantes en question et, d'autre part, de déterminer lequel des deux constituants était

la cause des accidents observés. On à utilisé, à cette fin deux échantillons de la préparation en question: le premier était préparé par la Société Hellenique de Produits Chimiques et d'Engrais et le second fabriqué à Hollande. Les dites poudres ont été appliquées sur un petit nombre de plantes à Kiphissia.

De ces essais il fut constaté que les produits utilisés provoquent des brûlures sur l'artichaut. Les dégâts observés étaient d'une part analogues à ceux des plantes de l'île de Rhodes et, d'autre part, à ceux provoqués par l'emploi du soufre seul.

AUBERGINE

1. Le *Macrophomina phaseoli* (Maubl.) Ashby fit des dégâts assez importants dans la région de Kozani.

2. Le *Verticillium albo-atrum* Reink. et Berth. à Frangoklissia en Attique.

3. Le *Rhizoctonia solani* Kühn dans la même région et à Servia de la région de Kozani.

CHOU

Le *Phoma lingam* (Fr.) Desm. fut trouvé sur des graines importées de Hollande. Le lot en question fut détruit.

PIMENT

1. Le *Macrophomina phaseoli* (Maubl.) Ashby dans la région de Kozani. Dégâts importants.

2. Le *Rhizoctonia solani* Kühn à Servia de la même région.

POMME DE TERRE

1. Le *Rhizoctonia solani* Kühn dans la région de Komi aux îles de Cyclades. Dégâts.

2. Une pourriture humide se manifesta sur les tubercules en silo par la suite de mauvaises conditions d'aération et de température à Agios Thomas dans la région de Thèbes. Les dégâts atteignirent un pourcentage élevé.

TOMATE

1. Un *Fusarium sp.* dans l'île de Thira. Dégâts assez importants. Le même cas à Marcopoulo en Attique.

2. La mosaïque Aucuba à Varibobi en Attique et à Zacharo dans la région d'Hilia.

3. La mosaïque du Tabac dans cette dernière région.

4. Des malformations des fruits (cutface) dues à des causes phy-

siologiques à Ierapetra dans l'île de Crète et à Kounoupitsa dans la région de Trezène.

SUR LÉGUMINEUSES

HARICOT

Le *Rhizoctonia solani* Kühn dans la région de Grevena (Kozani).

LENTILLE

Un *Ascochyta sp.* à Dourouti dans la région de Jannina (Épire).

LUZERNE

Le *Rhizoctonia crocorum* D. C. ex Fr. à Ptolemaïs de la région de Kozani et à Dourouti dans la région de Jannina.

POIS-CHICHE

L'*Uromyces ciceris-arietini* (Grogn.) Jacz. et Boyer à Gortys dans l'île de Crète.

VESCE

L'*Uromyces fabae* (Pers.) de Bary dans la région de Lamia.

ESPARCETTE

Le *Rhizoctonia solani* Kühn à Chalandri en Attique.

SUR CÉRÉALES

BLÉ

Le *Rhizoctonia solani* Kühn dans la région de Rodopi en Macédoine.

ORGE

L'*Erysiphe graminis* D. C. à Gortys dans l'île de Crète.

RIZ

Le *Piricularia oryzae* Cav. à Chrysoupolis dans la région de Nestos.

SUR PLANTES ORNEMENTALES

CHRYSANTHÈME

Une trachéomycose due à un *Cephalosporium*, causa des dégâts assez importants à Acharnai en Attique.

EVONYME

L'*Oidium sp.* sur feuilles à Kiphissia.

GLAÏEUL

Le *Fusarium oxysporum* Schlecht *var. gladioli* (Massey) sur bulbes à Kiphissia et à Marathon en Attique.

RAMNUS

Des pourridiés causés par le *Rosellinia necatrix* (Hart.) Berl. à Athènes et par l' *Armillaria mellea* (Vahl.) Quelet, à Kiphissia.

ROSIER

Un *Phragmidium sp.* sur les pousses et les feuilles à Agios Georgios dans l'île de Chio et à Athènes.

SUR PLANTES FORESTIÈRES

PIN

Un *Fusarium sp.* provoquant une fonte de semis à Velvendos dans la région de Kozani.

THE BACTERIAL CANKER OF TOMATOES IN GREECE

by

D. G. ZACHOS and S. G. GEORGOPOULOS *

In the region of Preveza, in the Northwest of Greece, tomato plants are grown in an area of about 4.000 stremmas** and constitute one of the most important crops of the above territory.

Owing to the favourable climatic conditions tomato fruits ripen early in summer and being offered in the market at the beginning of June, they can successfully compete the production of the southern districts of the country.

During the spring of 1957 the tomato plants were attacked by an unknown to the farmers disease causing a progressive wilting and stunting of the plants and a significant reduction of the expected crop.

Symptoms

The seedlings are transplanted from the greenhouse in the field usually in the middle of March. The first sign of the concerned disease was observed on the seedlings a few days later. This was a sudden wilting of some of the plants which did not alarm the growers probably ascribed to the different causes of damping-off. Later in the season, particularly from the middle of April to the end of May, the disease assumed a more destructive form attacking a bigger number of plants and causing considerable reduction of the yield.

At first sight the attacked plants present the picture of a progressive wilting simulating the type of a Fusarium wilt. Many of the lower leaves wither, turn brown and die. One observes a withering of the margins of the leaflets which later dry and curl upward (Fig. 1). Finally the blade becomes brittle and drops leaving the petiole attached to the leafstalk. A wilting of the leaflets on one side of the leafstalk is a common character of the disease. In some plants the wilting is limited to a small number of leaves but in others entire shoots may be affected.

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* Phytopathological Station, Patras, Greece.

** One stremma is 1000 m^2.

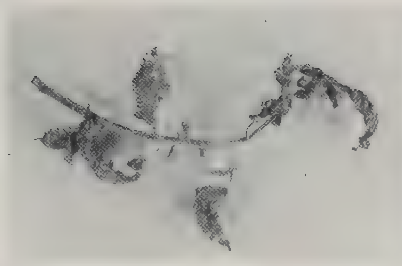
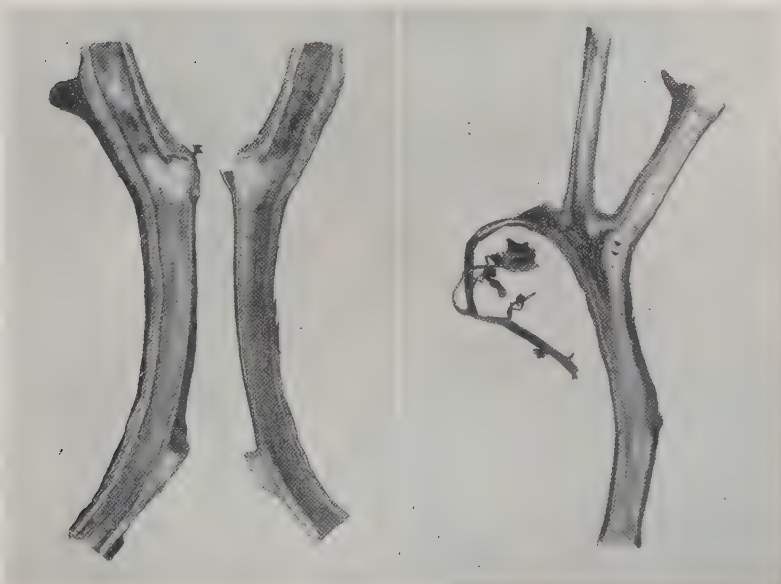


Fig. 1. Leaves presenting withering and curling of the leaflets caused by the bacterial canker.

Fig. 2. In the first row : a sudden wilting of the upper parts of apparently healthy plants caused by *C michiganense.*



Flg. 3. Longitudinal brown stripes in the cortex of the stem produced by *C. michiganense.* On the left, the streaking enters the petiole of a leaf.

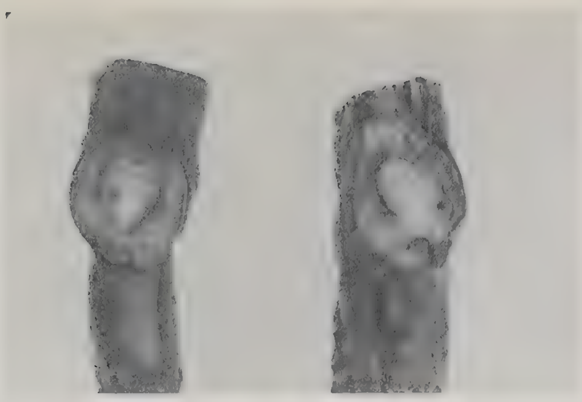


Fig. 4. Cross-section of a leaf-petiole showing crescent-shaped brown discolouration.

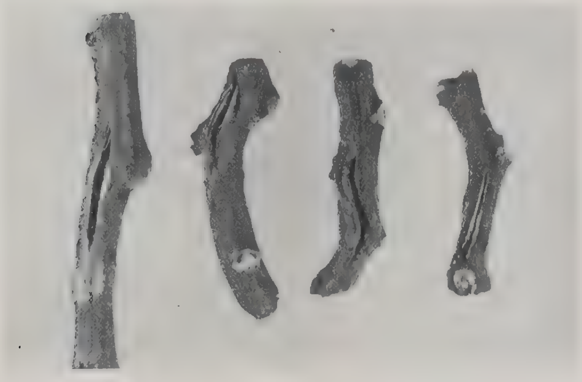


Fig. 5. Open cankers on tomato stems caused by *C. michiganence.*

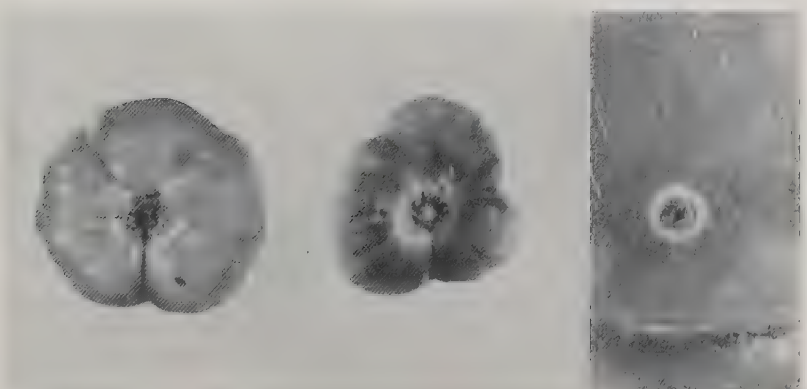


Fig. 6. Tomato fruits showing spots produced by the bacterial canker. On the right a spot magnified permitting to distinguish the brown discolouration surrounded by a white halo and the open center of it.

Besides the progressive withering of the leaves, a sudden wilting of the upper parts of some apparently healthy plants was noticed in the middle of June (Fig. 2). Dowson (4) states that this symptom is often observed when fruit is beginning to ripen. Our observations agree absolutely with the above statement.

Cutting the stem lengthwise one clearly distinguishes in the cortex light yellow or brown stripes running, though discontinued in some places, from the base to the top of the stem (Fig. 3). The streaking is not limited to the shoots but it also enters the fruit stems and the petioles of the leaves. The latter show a crescent-shaped brown discoloration in cross-section (Fig. 4).

The pith is detached from the woody portion of the stem in many parts of it and takes a yellow-brown colour.

When the distruction of the inner tissues extend to the outer surface of the bark the latter splits and open cankers, up to 7 centimeters long, appear (Fig. 5).

During the months of April and May nothing was observed on the fruits. But after the rains of the end of May the fruits also were affected. They presented the "bird's eye" spots, 1 to 3 millimeters in diameter. In the early stages these are white and raised. Later their center becomes brown and shows a slight opening surrounded by a white halo (Fig. 6). Anyway, the percentage of the affected fruits was very small.

In addition to the spring outbreak of the disease, in the same territory, summer and autumn crops were also affected by it with less damage.

Etiology

The above described symptoms correspond exactly to the symptoms ascribed to the Bacterial Canker caused by *Corynebacterium michiganense,* first described by E. F. Smith and named *Aplanobacter michiganense* (7).

In order to ascertain this we have tried to isolate and identify the pathogen. For its isolation and the study of its biochemical reactions the methods given by Dowson (4), Cunningham (3), Mackie and McCartney (6) and S. A. B. (8) have been applied.

From the petioles of wilted leaflets pure cultures of the parasite have easily been obtained. By the isolated pathogen young tomato plants having six to seven leaves were artificially inoculated. The inoculations were made by puncturing the stem with a needle and

the plants were kept at room temperature. After 13 to 15 days a wilting of the top of the inoculated plants was observed. This was followed by a general wilt of the plants and a complete collapse within a week (fig. 7). In addition to these symptoms, small cankers surrounded by a white halo were formed at the points of the needle punctures (fig. 7). Discoloration of the inner tissus of the stems was also noticed. The pathogen has been reisolated from the petioles of the wilted leaves.

This is a Gram positive, non motile bacterium having the shape of small curved rods measuring $0{,}6 - 1{,}3 \times 0{,}4 - 0{,}7\ \mu$. Under the microscope one often observes bacteria being arranged in the shape of the letter Y or the letter L (Fig. 8).

In Petri dishes containing meat-infusion agar the colonies appear the third or the fourth day in 23-24° C. Those of the surface are round and convex with entire margins and at first of a light yellow colour turning quickly to yellow. The burried colonies are also yellow.

On sterilized potato plugs the bacterium forms a slimy yellow mass.

Litmus milk is reduced and coagulated. On the surface there is a yellow rim.

Gelatin is liquified slowly and at the beginning in a saucer-like shape.

Starch is slightly hydrolized.

On peptonised meat broth there is a weak clouding. Nitrates are not reduced. There is production of ammonia but not of indol and of hydrogen sulphide.

By the above properties and biochemical reactions the isolated bacterium can be classified to the species *Corynebacterium michiganense* (E. F. Smith) Jensen (2, 4, 5, 7). This pathogen has never been noticed in Greece before.

In addition to the above biochemical reactions, the ability of the *C. michiganense* in the spliting of carbon compounnds was studied. The production of acid was qualitatively tested by incorporating the sugars in a synthetic medium (8) as one per cent solutions with bromocresol purple as indicator. Of the tested carbon compounds, xylose, dextrose, mannose, sucrose, lactose, glycerol and salicin are not fermented within a month's time. In the case of maltose a slight production of acid was noticed. In Elliott's (5) and Bergey's (2) description of *C. michiganense* is stated that there is production of acid from

Fig. 7. Left Tomato plant artificially inoculated by *C. michiganense* showing wilting the 19th day. Right. A piece of the stem of the same plant showing small cankers surrounded by a white halo at the points of the inoculation.

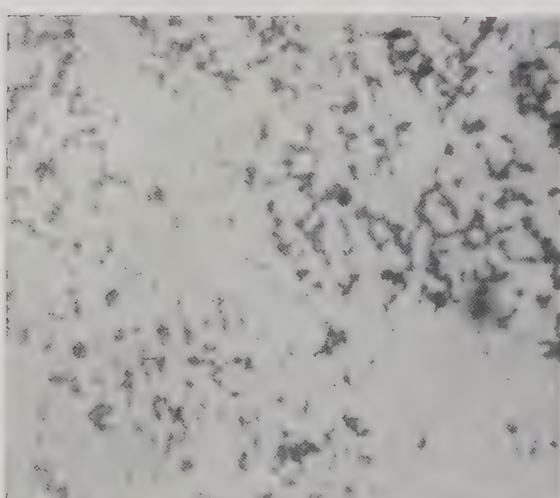


Fig. 8. A microscopic field showing an arrangement of the *C. michiganense* in Y and L shape.

dextrose, sucrose, galactose, levulose, maltose and very slight from lactose, glycerol and mannite. This is not in agreement with our results and in order to trace small quantities of acid, in the same medium bromocresol purple was substituted by bromothymol blue. Within a month a very slight production of acid was observed from dextrose, galactose, maltose, lactose and mannite and no acid at all from levulose, sucrose and glycerol. The obtained results indicate that *C. michiganense* cultivated in the above synthetic medium is a weak fermenter of sugars.

Epiphytology

Although the Bacterial Tomato Canker was observed in Preveza territory in spring of 1957 for the first time, we have reasons to believe that it has existed there in an epidemic form for at least four years.

The way *Corynebacterium michiganense* has come in Greece remains still unknown but we think that it was probably imported from the neighbouring infested countries during the German-Italian occupation.

The disease is perpetuated and renewed from year to year first by the infected seed because the growers use seed obtained from their contaminated crops. Second the soil of the greenhouse is neither renewed nor disinfected. So, the destruction of the seedlings either in the seedbed or immediately after their transplantation in the field is easily explained.

The spread of the disease in the field is greatly favoured by the habit of pruning the plants. That this practice constitutes a way of transmitting the disease has been demonstrated experimentally by Ark (1).

Finally we cannot exclude infections coming from the soil. It is well established that the bacterium retains its virulence in the soil for about two years and there are many growers who do not apply any rotation system.

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PHYSIOLOGIC RACES OF STEM RUST OF WHEAT IN GREECE IN 1953 AND 1954 AND THEIR PATHOGENICITY ON GREEK WHEAT VARIETIES[1]

By

GEORGE C. PAPAVIZAS[2]

Puccinia graminis f. sp. *tritici* Erikss. & Hen. is, perhaps, the greatest hazard in the winter and spring wheat growing areas of Greece. At irregular intervals epidemics of rust destroy immense quantities of grain. Some rust epidemics such as those of 1932, 1935, and 1948 have been so serious and widespread as to cause a decided shortage of food-stuffs.

The identity, prevalence, and pathogenic capabilities of physiologic races of *P. g. tritici* in Greece are unknown. Little is known of the source of inoculum or of the environmental factors that prevail when rust epidemics arise. The breeding program for resistant wheat varieties can not be sound and successful with so many unknown and unpredictable factors.

The studies reported herein were undertaken with two objectives in mind:

1) To obtain information on the stem rust race population in Greece, and

2) to determine the reactions of certain Greek and American wheat varieties and lines to several physiologic races of stem rust of wheat that occur in Greece or are most likely to occur there in the future.

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[1] Paper No 3820, Scientific Journal Series, Minnesota Agricultural Experiment Station. This work is a joint contribution between the Institute of Plant Breeding, Thessaloniki, Greece, and the Minnesota Agricultural Experiment Station.

[2] Instructor, Department of Plant Pathology and Botany, University of Minnesota.

MATERIALS AND METHODS

Physiologic races 15b, 32, 36, 38, 49, and 139 were obtained from the Federal Rust Laboratory at St. Paul, Minnesota. These races were collected from widely different parts of the United States. Race 11, 14, 17, 21, 34, and 75 were isolated in Greece in 1953 and 1954. The purity of these races was tested periodically on the 13 differential wheat varieties set up by Stakman et al (9). Cultures were propagated on Little Club, a wheat very susceptible to most of the races of stem rust described, and precautions were taken to avoid contaminations.

The wheat varieties used in this work were:

A. American Wheat Varieties

Khapli	C.I. 4013[1]
Lee	C.I.12448
Little Club	C.I. 4066

B. Italian Wheat Varieties

Mentana	YG-243[2]

C. Varietes selected or developed by the Institute of Plant Breeding, Thessaloniki, Greece

Eretria	G-202[3]	Libero×(Kenya×Sinai I)×Mentana	54326d
Xylocastron	G-3491	Kenya×(Sinai I×Ment.)×Rietti	57263
Lemnos	G-5770	(Kenya×Mentana)×Mentana	58325
Rietti ×Quality	G-38120	(Kenya×Mentana)×Quaderna	60381
Rietti ×Quality	G-38290	Ment.×(Kenya×(Camberra×Grinias)	58363
Rietti ×Quality	G-42855	(Camberra×Grinias)×Sel. Mentana	57826
Rietti ×Quality	G-46025	Mentana×Manitoba	58361
Rietti ×Quality	G-46713	Phalaris Minor×Petiblanco	59914
Rietti ×Quality	G-47035	(Quality×Rietti)×Manitoba	60215
Lemnos×Quaderna	53003	Duragio Portugal×Lemnos	60279
(Kenya ×Dux)×Quaderna	54136	*Triticum monococcum*	Kaploutzas
(Kenya ×Dux)×Quaderna	55571		
(Kenya ×Dux)×Quaderna	56595		
(Kenya ×Dux)×Quaderna	58333		

The inoculation technique consisted of rubbing with moistened fingers the leaves of 7-day old plants growing in 10-centimeter pots, placing those in an incubation chamber, spraying with sterile water to provide a fine film of moisture, dusting the plants with a mixture

[1] Cereal Investigation Accession Number, U.S. Department of Agriculture.

[2] Italian wheat introduced by the Institue of Plant Breeding, Thessaloniki.

[3] Investigation Accession Number, Institute of Plant Breeding, Thessaloniki.

of talc and urediospores and again spraying them with water. The inoculated plants were kept in moist chambers for 24 hours and then placed on greenhouse benches where hygrothermographs recorded a range of 22° to 24°C and 45 to 75 per cent relative humidity.

The various symptoms produced by the races, known as «infection types» and represented by symbols, were recorded 15 to 18 days after inoculation. The different host varieties that have been found most suitable for displaying the diversity of infection types are referred to as «differential hosts» or «differential varieties». The infection types used in the identification of physiologic races of *Puccinia graminis tritici* were described by Stakman and Levine (8), and these have been adopted generally for the other cereal rusts, modified as necessary to suit the individual characteristics of the particular rust. The following symbols adapted from Stakman et al (9) are used to indicate the types of infection on the varieties tested (Fig. 1).

0. Host immunne. No uredia developed; hypersensitive flecks usually present.

1. Host very resistant. Uredia isolated and minute; surrounded by sharp, continuous, hypersensitive necrotic areas.

2. Host moderately resistant. Uredia isolated and small to medium size; pustules often in green but slightly chlorotic islands.

3. Host moderately susceptible. Uredia medium in size, not coalescing; true hypersensitiveness absent; chlorotic areas may be present.

4. Host very susceptible. Uredia large, numerous and confluent; true hypersensitiveness entirely absent, but chlorosis may be present when conditions are unfavorable for rust development.

X. Host reaction heterogenous. Uredia variable, apparently including all types and degrees of infection on the same blade; no mechanical separation possible; on reinoculation spores from small uredia may produce large ones and vice versa.

RESULTS

Physiologic races of *Puccinia graminis tritici* in Greece in 1953 and 1954

Leaves and stems from infected wheat, barley and grasses were collected in Greece in 1953 and 1954, the inoculum was propagated on Little Club, and the infected seedlings of Little Club were used

to inoculate the 13 «standard differential varieties» employed in the identification of stem rust races.

From 33 such uredial collections of wheat stem rust 41 isolates were identified, comprising 7 races and one recognizable biotype (Table I). Race 21 was the most prevalent race in 1953 and 1954, comprising 43.9 per cent of the isolates. It was found in all of the districts of the country except Thrace and Crete. Since only 1 and 4 collections were obtained from these two districts, respectively, perhaps several other races escaped identification. Race 14 came second in prevalence comprising 14.6 per cent of the isolates, whereas race 17 was third. Races 11, 34, 40, and 75 were less prevalent than races 14, 17, and 21; they comprised only about 25 per cent of the total number of isolates. A biotype of race 14 was isolated differing from ordinary race 14 in its ability to attack Khapli wheat, which is immune to ordinary race 14.

With the exception of race 11 and the biotype of race 14, which were found for first time in Greece in 1954, races 11, 17, 21, 34, 40, and 75 had previously been described in Greece, Bulgaria and Turkey (1). The lack of shift in the prevalence of physiologic races of stem rust of wheat over a period of more than twenty years can not be readily accounted for, because barberry, and especially *Berberis cretica* L., the host whereupon the rust develops new races and biotypes, has been found to be rusted heavily during the summer (3, 6). The author is unwilling to propose any explanation on the basis of results obtained only twice in more than twenty years.

Reaction of Greek Wheat Varieties to Stem Rust Races

Table II is a summary of seedling reactions of 26 wheat varieties to 13 physiologic races of stem rust found in Greece and in the United States of America. The selections Eretria (G-202), Xylocastron (G-3491), and Lemnos (G-5770), the indigenous variety Kaploutzas and the Italian variety Mentana (YG-243) have shown in the seedling stage a high degree of susceptibility to almost all of the races used. They were moderately to completely susceptible to races 11, 14, 17, 21, 34, and 75, which comprised more than 80 per cent of the races found in Greece in 1953 and 1954.

The varieties G-38120, G-38290, G-42855, G-46025, G-46713, and G-47035 derived from a cross between Rietti and Quality wheats, made at the Institute of Plant Breeding, Thessaloniki, showed a re-

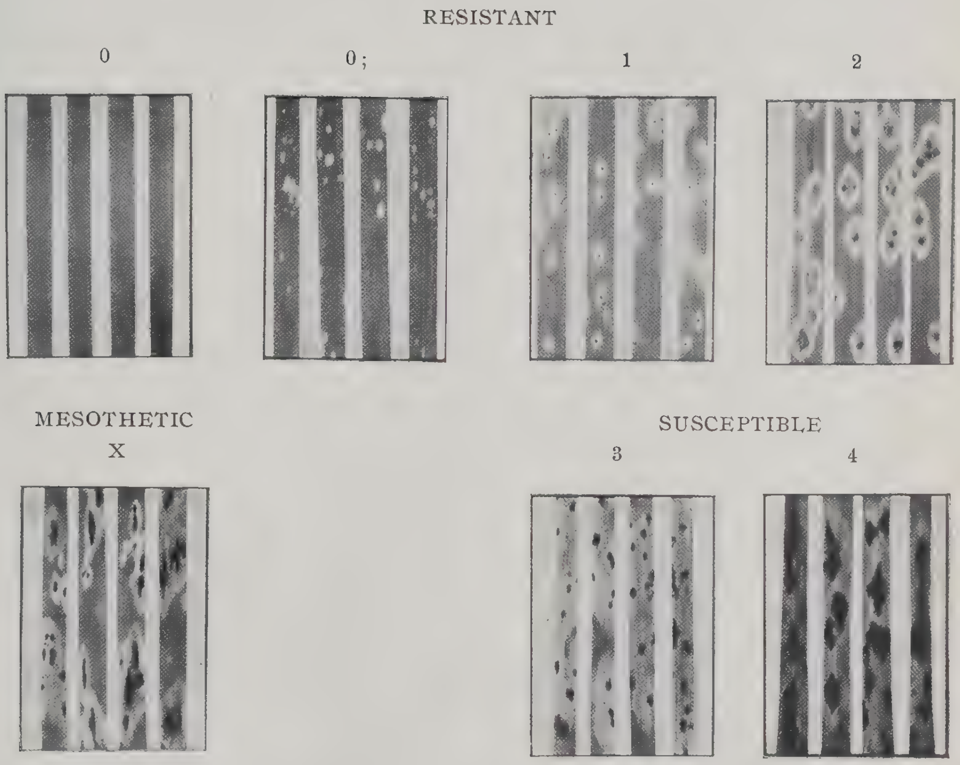

Fig. 1. Infection types produced by physiologic races of *Puccinia graminis* f. sp. *tritici* on wheat differential varieties.

(Courtesy of the Rust Prevention Association, Minneapolis).

TABLE I

Physiologic races of *Puccinia graminis tritici* isolated from uredial collections[1] in Greece in 1953 and 1954[2]

District	Race and number of times isolated								Total number of		
	11	14	14bio.	17	21	34	40	75	isolates	races	collections
Epirus	2	—	—	—	2	—	—	—	4	2	4
Western Macedonia	—	2	—	—	3	—	2	—	7	3	5
Central Macedonia	—	3	1	2	7	1	—	—	14	5	10
Eastern Macedonia	—	—	—	—	2	—	—	—	2	1	2
Thrace	—	—	—	—	—	—	1	—	1	1	1
Thessalia	—	1	1	—	4	2	—	1	9	5	7
Crete	—	—	—	3	—	—	1	—	4	2	4
Totals	2	6	2	5	18	3	4	1	41	19	33
Percentage of isolates	4.9	14.6	4.9	12.2	43.9	7.3	9.8	2.4			

[1] From wheat, barley and grasses.
[2] Most of the collections were identified at St. Paul, Minnesota.

TABLE II

Seedling reactions[1] of 26 wheat varieties to 15 races of *Puccinia graminis tritici*[2]

Variety	Physiologic races														
	11	14	15B	15B	15B	17	21	32	34	36	38	49	56	75	139
G—202	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
G—3491	MS	S	S	S	S	S	S	MS	S	S	S	MS	S	MS	MS
G—5770	MS	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Kaploutzas	MS	S	S	S	S	S	S	MS	S	S	S	S	MS	S	VR
YG—243	S	MS	S	S	S	S	S	MR	S	S	MR	MS	MS	MS	MR
G—38120	R	MR	MS	MS	S	S	S	R	MS	MR	MR	MR	MR	S	VR
G—38290	R	MR	MS	MS	S	S	S	R	MS	MR	R	MR	MR	MS	VR
G—42855	R	MR	MS	MS	S	S	S	VR	MS	R	R	MR	MR	S	VR
G-46025	R	MR	MS	MS	S	S	S	R	MS	R	R	MR	MR	MS	VR
G—46713	MS	MR	MS	MS	S	S	S	MR	MS	R	MR	MR	MR	MS	VR
G—47035	MS	MR	MS	S	S	S	S	VR	MS	R	MR	MR	MR	MS	MR
53003	MS	MR	MS	S	S	S	S	MS	MS	S	MS	MS	MS	MS	MR
54136	MS	MR	S	S	S	MR	MR	VR	R	R	MR	VR	MR	MR	MR
55571	VR	MR	S	MS	S	MR	MR	R	MS	VR	MR	VR	MR	MS	VR
56595	R	MR	MR	R	MS	MR	MR	MR	R	R	R	VR	R	MR	VR
58333	VR	MR	MS	MS	S	MR	MR	VR	MR	R	MR	VR	MR	MR	VR
54326 d	MS	S	S	S	S	S	S	S	S	S	MS	S	S	S	MS
57263	R	MR	S	S	S	MR	MR	VR	R	R	MR	VR	MR	MR	MR
58325	MR	MR	MR	R	S	S	MS	VR	MS	MR	MR	VR	MR	MR	MR
60381	MS	S	S	S	S	S	R	MS	S	S	MS	MS	MS	R	S
58363	VR	R	S	MS	MS	MR	MR	VR	VR	R	R	VR	MR	MR	VR
57826	R	MR	MR	MS	MS	MS	MS	VR	R	R	R	VR	R	MR	MR
58361	MS	VR	S	MS	S	VR	VR	VR	MR	MR	MS	VR	MS	MS	VR
59914	S	MR	S	S	S	S	S	S	S	S	S	S	S	S	S
60215	S	MS	S	S	S	S	VR	S	S	S	S	S	S	S	S
60279	MR	S	S	S	S	S	S	S	S	S	S	S	S	S	S

[1] The equivalence between infection types and reactions is as follows:

Reaction		Infection type
VR	Very resistant	0 ; to 1=
R	Resistant	1— to 1++
MR	Moderately resistant	2= to 2++ and X—
MS	Moderately susceptible	3— to 3+ , X to X+
S	Susceptible	4= to 4++

[2] The results are average of four replications.

markable degree of uniformity in their reactions to the races tested. For instance, limited sporulation of the rust and large chlorotic and necrotic areas surrounding the rust pustules were noticed on these varieties infected with all of the races used. This group of wheat varieties was susceptible to race 15B, 17, and 21, moderately susceptible to races 34 and 75 and moderately resistant or resistant to the rest of the races employed. The complete susceptibility of these derivatives of the Rietti x Quality cross to races 17 and 21 should be seriously considered in any breeding or distribution program in the country, in view of the fact that races 17 and 21 comprised more than 50 per cent of the rust population in Greece in 1953 and 1954.

The newer wheat lines 53003, 54326d, 58361, 59914, 60215, 60279, and 60381 were moderatelly to completely susceptible to the majority of the races used in the present work. On the other hand the lines 54136, 55571, 56595, 57263, 57826, 58325, 58333, and 58363, demonstrated a high degree of resistance to all of the races tested, with the exception of race 15B. Only lines 56595 and 58325 had some degree of resistance to some of the isolates of race 15B.

Effect of Temperature on the Reactions of some Wheat Varieties to two Biotypes of Race 15B

From 1949 to 1956 inclusive many different races of *P. g. tritici* were found in Canada, Mexico, and the United States. Among them was the very virulent race 15B, to which all of the otherwise resistant varieties of bread wheat and durum grown were susceptible. This new and dangerous race became prevalent suddenly and dramatically in 1950 and remained so thereafter. Race 15B ruined thousands of acres of the most rust resistant wheats that had been laboriously developed in Mexico, it caused heavy losses to all resistant varieties in North America, and in 1953 and 1954 it ruined the durum wheat crop of the United States and caused extensive damage to hitherto resistant bread wheats (7).

Certain Kenya wheats seemed to be highly resistaut to race 15B, but it was soon found that some of them were resistant only at moderate temperatures and completely susceptible at high temperatures, when resistance is most needed. Shukla (5), for instance, found that Kenya wheats were moderately susceptible to race 15 when temperatures were maintained continuously at 25° or 30°C. or as high as 32 to 37°C., whereas they were resistant at 18 to 24°C.

The Institute of Plant Breeding at Thessaloniki, Greece, is using Kenya wheats as sources of resistance to stem rust of wheat and some of the new varieties resistant to the most prevalent races in the country (Table II) have Kenya as one of their parents. Since possibilities of introduction or development of race 15B in the country always exist, and since the temperatures during the growing season are often well over 24°C, the effect of temperature on the reactions of three America and ten Greek wheat varieties to two distinct biotypes of race 15 B was studied in the following manner. Single spore cultures of each of the two biotypes were first obtained, and cultures derived from these spores were used as inoculum throughout the study. The varieties were inoculated as described in the section Materials and Methods and were exposed to 18, 24, and 28°C. The results are summarized in Table III.

In general, uredial development, appearance of chlorotic areas around the rust pustules and rupture of the leaf epidermis were considerably accelerated by high temperatures. No significant differences were observed in the infection types produced on Khapli, Little Club, Lee, 56595, and 58363 by both biotypes of race 15B at the three temperatures. Line 56595 showed a remarkable constant reaction at the three temperatures used; it was moderately susceptible to the ordinary biotype of race 15B designated 52-13-11 at 18, 24, and 28°C and resistant to the Oklahoma biotype designated 52-34-22. All of the 17 biotypes of race 15B described (4) attack the 13 differential varieties except Khapli. The Oklahoma biotype is capable of attacking Khapli at certain conditions of temperature and intensity of light in addition to being able to attack the 12 other differential varieties (2).

The partial resistance shown by the lines G-42855, G-46025, 55571, 58325, 58333, and 58361 to one or both biotypes of race 15B at lower temperatures, was broken down when these varieties were exposed to temperatures above 24°C. For instance, line 55571 was very resistant to the Oklahoma biotype at 18°C, the infection type being 1, while it became very susceptible at 24 and 28°C (Fig. 2). When plants of this variety were inoculated at the boot stage with the Oklahoma biotype their mature plant reaction to this isolate was identical with the reaction obtained at the seedling stage. Plants exposed to 18°C for 25 days, and subsequently to 24°C until the hard-dough stage, were resistant, whereas those exposed to 28°C from the time of inoculation at the boot stage to the time of full maturity were completely susceptible (Fig. 3).

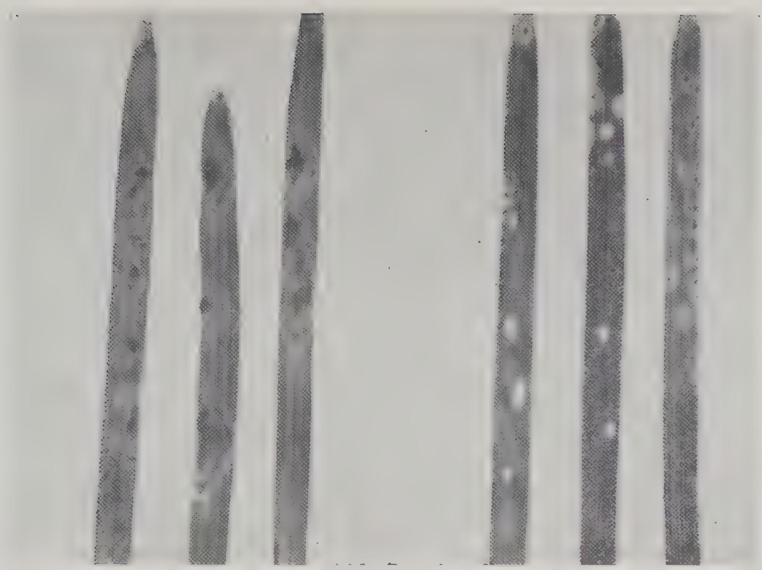

Fig. 2. Seedling reaction of the variety 55571 to the Oklahoma biotype of race 15B at 28°C (left) and at 18° (right).

Fig. 3. Mature-plant reaction of the variety 55571 inoculated at the boot stage with the Oklahoma biotype of race 15B. Left, inoculated plants were exposed to 18°C for 25 days and subsequently to 24°C; right, inoculated plants were exposed to 28°C until maturity.

TABLE III

Infection types produced by two biotypes of races 15B on seedlings of thirteen wheat varieties at three different temperatures[1]

Wheat variety	Race 15B					
	52 — 13 — 11[2]			52 — 34 — 22[3]		
	18° C	24° C	28° C	18° C	24° C	28° C
Khapli	0;[4]	0;	0;	2—[5]	3	4—
Lee	4=	4—	4	4—	4—	4
Little Club	4—	4	4++	4=	4+	4++
G—38290	2=	2—	3	3=	3	3+
G—42855	2=	3=	3+c	2—	3+	3+
G—46025	2=	2—	3	1	2	4
55571	4—	4	4+	1—	4—	4—
56595	3=	3—	3+	1—	1	1
58333	2—	2+	4	2=	2	4+
58325	1=	3c	3+	2—	3—	3
58363	3+	3++	4	3+	4=	4++
57826	2—	3	3+	3=	3—	3
58361	2=	3	4+	2=	2=	4

[1] Figures are average of four replications.
[2] Normal biotype of race 15B.
[3] Oklahoma biotype of race 15B.
[4] Miscellaneous symbols : (;) — hypersensitive flecks . (c) — chlorosis.
[5] Plus and minus signs are used to indicate variation within a given type: ++ and = indicate the upper and the lower limits respectively, of each type.

DISCUSSION

The reduction of losses from stem rust of wheat by growing resistant varieties is a certain and feasible method, as shown by the resistance of certain wheats, but has been restricted in its application by the continuous arising of new physiologic races capable of attacking previously resistant varieties. The isolation and identification of such new and virulent races, and the testing of new varieties with these races every year is of paramount importance for the establishment of a sound and successful breeding program.

The development of a resistant cereal variety, for example, of wheat, is a rather slow process, requiring from 8 to 12 years and a modern and indispensable test should involve the testing of this variety to a composite of rust races being comprised not only of the most prevalent ones in a wide territory but also of those likely to become prevalent in the future. Without such continuous tests in rust nurseries against all of the races identified from cereals, grasses, and barberries for a number of years, a great risk is assumed of spending considerable effort on a variety to be soon proven worthless.

In Greece a regular rust race survey program has never been established. As far as the writer is aware only two race surveys were made, the first in 1932-34 (1) and the second in 1953-54 by the author of the present paper. Although most of the races found in 1932-34 were again present in 1953-54, nevertheless it should be emphasized that these results are fragmentary and cannot be used as sound criterion in developing wheat varieties resistant to stem rust.

A limited number of varieties were tested. Many other varieties might have been included, but owing to the great amount of work involved in testing a variety, it was not found possible to include them. Among those reported on, however, are many of the most promising of the rust-resistant wheats produced in recent years. It should perhaps be stated that not all of the races present in Greece were included in these tests. Those used, however, were sufficiently numerous and diverse in character to give a fairly accurate idea of the resistance and susceptibility of each wheat variety. The inclusion of race 15B and certain other races commonly found in America, North Africa and Western Europe, but not yet reported in Greece, gave a wider spectrum of races which might become prevalent in the future.

The reactions summarized in Table II are the reactions of seedlings only, and they may not be identical with the reactions of the

mature plants. Further tests are required to establish the relationship between seedling and mature-plant reaction of these varieties.

Kenya derivatives were resistant to all of the races prevalent in the country, whereas the derivatives of the Rietti × Quality cross, already released as commercial varieties, showed in the seedling stage a uniformly susceptible reaction to races 17, 21, 34 and 75, which comprised more than 60 per cent of the rust population in Greece in 1953-54. If we disregard the possibility of introduction or arising of race 15 B in Greece, the Kenya derivatives have such a genetic make up as to resist most of the races found in the country. Additional studies, however, should be carried out to establish both their mature-plant reactions to common races and biotypes and their behavior at temperatures above 24°C.

SUMMARY

1. Seven races and one recognizable biotype of *Puccinia graminis* f. sp. *tritici* were identified in 41 isolates from 33 uredial collections. Races 14 and 21 comprised 59 per cent of the isolates. The remaining 41 per cent included races 11, 17, 34, 40, 75, and a biotype of race 14.

2. Seedling reactions of twenty-six wheat varieties to thirteen physiologic races of stem rust of wheat were studied. Derivatives of the Rietti × Quality cross (G-38120, G-38290, G-42855, G-46025, G-46713 G-47035) were susceptible to races 17, 21, 34, and 75 and resistant to the other races tested. The Kenya derivatives (54136, 55571, 56595, 57236, 58235, 58333, 58363) and the cross (Camberra × Grinias) × Sel. Mentana (57826) were resistant to most of the races used, whereas all of the other varieties tested were susceptible to most of the races. With the exception of 56595 and 58325 all of the varieties tested were completely susceptible to the isolates of 15 B tested at 24°C.

3. No significant deviation from the normal reactions of the varieties Khapli, Lee, Little Club, and the lines 56595, 57826 and 58363 to two biotypes of race 15 B occured at 18, 24, and 28°C. The reactions of G-38290, G-42855, G-46025, 55571, 58325, 58333, and 58361, however, changed from resistant to susceptible with an increase of temperature from 18 to 28°C.

ACKNOWLEDGMENTS

The writer wishes to greatfully express his deep appreciation to Dr. Demetrios Talellis for his continued encouragement during the process of this work and for providing the seeds of the Greek varieties; and to Federal Rust Laboratory at St. Paul, Minnesota, for providing facilities, some wheat varieties and several races and biotypes of stem rust.

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THE BROWN ROT OF POTATOES IN GREECE

by

D. G. ZACHOS

The Brown rot of Potatoes was not recorded in Greece till 1951 when the Benaki Phytopathological Institute observed for the first time the Brown rot symptoms on tubers sent from the region of Amphissa (Central Greece). In 1953 the same disease attacked the potato crops of the Naxos island. In both places the disease caused great losses.

No attempts have been made, so far, to isolate and identify the causal organism.

In late spring of 1957 potato tubers were sent to our laboratory from the potato growing center of Messini (Southern Peloponnesus). Some of the tubers appeared healthy on the outside while others showed a brown to black discolouration around the eyes and a slimy ooze exuded from them. Particles of soil and wood debris adhered to it. The affected tubers when cut revealed a browning of the vascular ring. By squeezing them slightly a cream coloured exudate oozed from the vascular ring. The apparently healthy tubers presented internally the same symptoms (Fig. 1).

From the later a bacterial organism was isolated in pure culture and by this we inoculated tomato plants. These were about 20 centimeters high and the inoculations have been made by puncturing their stems with a needle. The inoculated plants as well as the controls were maintained under conditions of high humidity for 48 hours. Seven to eight days later the inoculated plants showed a sudden wilting (Fig. 2). The reisolated organism was identical with the original isolate.

During September of the same year new samples including potato plants were sent to our laboratory from Avlon, another potato-growing center near Athens. In that case the plants belonged to summer crops, about one month old, and showed a sudden wilting. Their vascular bundles were brown and clogged with bacteria. The same discolouration was evident as brown stripes on the surface o

the affected stem near the foot. Small tubers of the size of chick-peas formed by the young plants when cut across did not present any browing of the vascular ring but by squeezing them the caracteristic cream-coloured ooze exuded from the bundles. From these tubers pure cultures of the pathogen were obtained and the bacterium proved to be identical with the one isolated from tubers coming from Messini.

It is a Gram negative rod-shaped motile bacterium. In Petri dishes containing meat-infusion agar it forms smal, round and flat colonies with entire margins. These are milk-white and shining, of a slimy consistency, surrounded by a bluish halo.

In slope cultures on meat-infusion agar one observes at the margins of the colony also a bluish or yellowish-green fluorescence. In such cultures the bacterial mass often flows down forming a long white band (Fig. 3). This has been described by E. F. Smith (3).

On meat broth there is a moderate clouding within 24 hours. Later a pellicle is formed.

On sterilized potato plugs it forms a white slimy mass later turning brown.

Litmus milk is not coagulated but slowly digested.

Gelatin is not liquefied.

Starch is slightly hydrolysed.

Nitrates are reduced.

There is production of ammonia and of hydrogen sulphid but not of indol.

The biochemical reactions of carbon compounds are given in the table I.

TABLE I

Fermentation of carbon compounds by *Pseudomonas solanacearum* E. F. Smith

Xylose	Dextrose	Mannose	Sucrose	Lactose	Maltose	Glycerol	Salicin
—	+	+	+	+	+	+	—

\+ denotes acid production
— » no »

The above caracters and biochemical reactions allowed to iden-

Fig. 1. Potato tubers affected by *Pseudomonas solanacearum* showing the browning of the vascular bundles.

Fig. 2. Left. Tomato plant artificially inoculated by *Pseudomonas solanacearum* showing a sudden wilting the 7th day after the inoculation. Right. Healthy control.

Fig. 3. Culture of *Pseudomonas solanacearum* on meat-infusion agar slopes showing the flowing down of it.

tify the isolated pathogen from potatoes as *Pseudomonas solanacearum* E. F. Smith (1, 2, 3).

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UNE BACTÉRIOSE DES OLIVES
(Note préliminaire)

par

D. G. ZACHOS

Au début du mois de septembre 1957 la Station Phytopathologique de Volos* nous a envoyé des échantillons d'olives présentant une attaque inconnue en Grèce et, à notre connaissance, n'ayant pas été décrite [1] jusqu'à présent dans d'autres pays oléicoles.

Sur les olives encore vertes apparaissent, autour des lenticelles, des taches circulaires de 0,5 à 2,5 millimètres de diamètre ou irregulières, d'une couleur brune qui devient plus tard brun foncé ou noirâtre (Fig. 1). Les taches se développant au début dans la zone des lenticelles, qui est d'une couleur plus claire que les autres parties de la surface de l'olive, apparaissent être entourées par un halo blanchâtre qui se forme par la partie de cette zone qui n'est pas entièrement occupée par la tache. On observe ces taches sur les variétés d'olives de table qui ont une zone autour des lenticelles assez développée. Par contre, sur les olives de petite taille les taches se présentent comme des simples points bruns. Celles-ci se présentent un peu élevées au début s'enfonçant plus tard. Finalement leur centre se fend et de la fissure sort une substance gélatineuse pleine de bactéries.

Les lésions décrites ne pénétrent pas en grande profondeur dans le fruit mais elles se forment aux couches superficielles du mésocarpe jusqu'à une profondeur de 0,3 millimètres environ.

Ces lésions n'entrainent pas la pourriture totale des olives mais elles réduisent considérablement leur valeur commerciale. Sur la sur-

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* Nous tenons à remercier vivement le Directeur de la Station Phytopathologique de Volos M. M. Souliotis qui a mis à notre disposition un grand nombre d'olives attaquées et nous a donné des renseignements sur l'évolution de la maladie dans la région de Volos.

[1] Petri a noté sur les olives des taches brunes dues à une bactérie qui n'a pas été isolée. (Rassegna dei casi fitopatologici osservati nel 1939. Boll. R. Staz. Pat. Veg., anno XX, N. S., 1940, p. 12.

Fig. 1. Olives présentant des taches causées par la bactérie dans la nature.

Fig. 2. Olives présentant des taches causées par la bactérie inoculée artificiellement.

face d'un seul fruit on peut souvent compter plus de vingt taches.

La maladie a été observée aux olivettes de Pelion, à celles des régions d' Almyros et d' Amphissa ainsi qu'aux olivettes des îles de Sporades et d'Eubée. Dans toutes ces régions on cultive, pour la plupart, des olives de table. Le nombre des fruits endommagés fut calculé chez certains arbres au dessus de 50 °/₀. Dans le Péloponnèse nous avons aussi constaté la maladie sur des variétés d'olives à huile. Enfin, d'après les renseignements qui nous sont parvenus, la maladie a aussi été signalée dans l'île de Crète.

Des olives attaquées nous avons pu isoler en culture pure une bactérie, qui inoculée artificiellement a provoqué sur les fruits l'apparition de taches absolument semblables à celles observées dans la nature (Fig. 2). De celles-ci nous avons reisolé la même bactérie. Sa culture sur des substrats différents ainsi que certaines réactions biochimiques nous ont permis de la classer au genre *Pseudomonas*.

Les recherches se poursuivent pour déterminer l'espèce de la bactérie isolée et les conditions du développement de la maladie dans notre pays.